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II.—On the *Goniatites* found in the Transition Formations of the Rhine. By M. ERNEST BEYRICH\*.

[With Plates.]

WE are indebted to M. Leopold von Buch for the establishment of a decided and precise separation between the *Ammonites* and the *Nautili* †. He has pointed out what must be considered an essentially different organization in the former of these Cephalopods: in fact, the siphuncle does not penetrate the transverse plates as in the *Nautilus* and other kindred genera, with the single function of fixing the animal strongly to the shell, but is prolonged between the chambers and the shell, as a much more important organ, and like a solid ligament surrounds the animal to the very extremity of the exterior.

The *Goniatites* must be considered as one division of the *Ammonites*; they are the representatives of the genus in the oldest fossiliferous rocks of the transition formations and of the carboniferous strata. The *Goniatites* are distinguished from the *Ammonites* by the more simple divisions of the chambers which are not denticulated like the leaves of a flower, and have lobes following a law less simple and precise than that which governs the formation of the more recent *Ammonites*. In some species indeed the lobes are scarcely perceptible, and they might be mistaken for *Nautili*, if it were not for the dorsal lobe, which necessarily accompanies the dorsal siphuncle. The greater part of the *Goniatites* have but one lateral lobe, which is sometimes greatly rounded, sometimes angulose and infundibuliform, and sometimes linguiform. When there

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The *Goniatites* are extensively distributed in the transition formations; they are found in very large quantities in the old transition limestone of the Fichtelgebirge. Count Münster has described a great number of species of that locality\*, and they ascend and appear even in the superior beds of the carboniferous measures, properly so called, where they are found amidst the debris of a mighty vegetation, the sole and last remains of the animal kingdom. In the limestone of the Fichtelgebirge, they occur with *Trilobites*, *Orthoceratites* and *Clymenia*: the *Trilobites* and *Orthoceratites* ascend as far as the carboniferous measures; the *Clymenia*, on the contrary, which differ from the *Goniatites* in the position of the siphuncle, and ought to be considered as true *Nautili*, have not hitherto been found either in the carboniferous limestone or in the recent transition formations, amongst which the schistose rocks of the Rhine arrange themselves †.

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Before I proceed to the individual description of the different species, I consider it necessary to explain the determination of the proportions of these fossils, characteristics introduced for the first time into the science by M. von Buch, and of which I have also availed myself in the description of the several species. The increase in diameter, the height of the spire, or more simply the height, expresses the proportion in which the height of the mouth increases in the space of an entire whorl. The height of the mouth is measured on two succeeding whorls, and the lesser of these dimensions is put down as a decimal fraction of the greater, which is taken for unity. The height of the mouth may be estimated in two ways: by taking the perpendicular dropped from the middle of the back, either as far as the suture or as far as the middle of the back of the preceding whorl. As the degree of involution in the outer circles is always the same as in the inner circles, we ought by these two estimations to obtain the same result for the increase in height. The increase in breadth, or simply the breadth, expresses the proportion in which the breadth of the mouth (that is to say, the dimension perpendicular to the height) increases in the space of an entire whorl—measure again here the breadth on two whorls which cover each other, and set down the lesser number as a decimal fraction of the greater. The increase in height and the increase in breadth are very certain proportions for the different species; taken together with the involution, these characters completely determine the form of an Ammonite. The thickness which expresses the proportion between the height and the breadth of the mouth depends on the two first proportions; it varies in each respect whenever the height (and

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### Section I. NAUTILINI.

The dorsal lobe simple, infundibuliform or linguiform; there is *one* single lateral lobe, smooth and rounded, which sometimes disappears entirely.

#### 1. *Ammonites subnautilinus*, Schlotth.

A. Næggerathi, *Goldf. and Von Buch, Goniât.* Pl. I. fig. 6—11.

? A. evexus, *L. von Buch, Goniât.* p. 33. Pl. I. fig. 3—5.

The dorsal lobe infundibuliform; depth equal to two or three times the breadth. The lateral lobe is large, occupying the whole extent of the side, it even descends nearly the whole depth of the dorsal lobe, and returns towards the suture, with a somewhat greater inclination, to the height of the dorsal saddle\*. The increase in height is 0·5 to 0·55; the increase in breadth 0·68 to 0·72; there are 14 chambers in one complete whorl. The number of whorls is 6 or 7: the inner whorls are almost entirely enveloped, never more than one fourth of them being perceptible.

M. von Buch has already observed, that the *A. Næggerathi*, Goldf., does not essentially differ from the *A. subnautilinus*, Schl. In these two Ammonites the lobes have a form altogether similar; the height and the breadth scarcely differ, and the somewhat less complete involution of *A. Næggerathi* will scarcely suffice to constitute a variety: still less can the more discoid form of the latter be regarded as a distinctive character. We must be very cautious in the appreciation of the exterior form, and in the use of that characteristic for the di-

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that happens almost constantly) does not increase in the same proportion as the breadth. For this reason I have entirely neglected its determination; moreover, for the distinction of the several species, we must not attach to these numerical proportions a greater degree of importance than they really deserve. If, in general, questions concerning organic bodies cannot be mathematically determined, we may with still greater reason in the present instance disregard little discrepancies; dealing as we are with fossils, the imperfect preservation of which seldom permits a great degree of accuracy of admeasurement.

### Section I. NAUTILINI.

The dorsal lobe simple, infundibuliform or linguiform; there is *one* single lateral lobe, smooth and rounded, which sometimes disappears entirely.

#### 1. *Ammonites subnautilus*, Schlotth.

A. Næggerathi, *Goldf. and Von Buch, Goniat.* Pl. I. fig. 6—11.

? A. evexus, *L. von Buch, Goniat.* p. 33. Pl. I. fig. 3—5.

The dorsal lobe infundibuliform; depth equal to two or three times the breadth. The lateral lobe is large, occupying the whole extent of the side, it even descends nearly the whole depth of the dorsal lobe, and returns towards the suture, with a somewhat greater inclination, to the height of the dorsal saddle\*. The increase in height is 0·5 to 0·55; the increase in breadth 0·68 to 0·72; there are 14 chambers in one complete whorl. The number of whorls is 6 or 7: the inner whorls are almost entirely enveloped, never more than one fourth of them being perceptible.

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stinction of species, where, as in this case, the height and the breadth increase in entirely different ratios. A necessary consequence of the more rapid increase in height than in breadth is, that according to the law of geometrical progression, the thickness in the outer whorls diminishes very rapidly also, and it follows that the ammonite in its growth takes a form more and more discoid. In the *A. subnautilus* the difference between the increase of height and that of breadth is already great enough to render this character very evident. It appears to me that the fragment described by M. von Buch, under the name of *A. evexus*, ought to be restored to the present species; it presents no character that permits the establishment of a specific distinction between them. In the *A. subnautilus*, as in this, the transverse plates are elevated in the middle, and their greatest depth found to be on the edges near the lobes.

The *A. subnautilus* is met with in the limestone of the Eifel near Gerolstein, and in the state of pyrites in the clay slate of Wissenbach (*Thonschiefer*). From these two localities I have at present seen only casts. The pyritose fossils of Wissenbach are almost always in the state of casts, and if any striae are visible they must be considered as belonging to the interior side of the shell, which was probably very thin.

2. *Ammonites lateseptatus*, n. s. Pl. I. figs. 1, 2, 3, 4.

The dorsal lobe infundibuliform; not much deeper than broad. There is no lateral lobe properly so called, that lobe being only indicated, in the early period of its growth, by an imperfect curve in the septa of the chambers. The increase in height is 0·70, the increase in breadth 0·65. There are but 10 or 11 chambers in one whorl. The number of whorls is 7, only a third part of the interior whorls is visible.

This ammonite is found with the preceding, in the clay slate of Wissenbach; it is well characterized by its form and by its lobes. As the height does not increase faster than the breadth, but rather more slowly, the thickness of the ammonite is not diminished in the exterior whorls, but is even somewhat increased. Figs. 1 and 2 of Pl. I. represent the finest example that I possess; there is very nearly a whorl and a half

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without a transverse plate. In order to see the lobes, one must take off a part of the last whorl, as is shown in fig. 2. In the outer whorls the breadth of the opening at the mouth is considerably greater than the height; consequently the side is very narrow, and the dorsal saddle, which is large and rounded, can scarcely be distinguished. The form of this ammonite would be perfectly spherical, if the inner whorls were not partly disengaged, and thus form a large and deep umbilicus. Upon the last whorl, destitute of transverse plates, the side falls towards the interior in an obtuse angle, presenting a well-defined ridge: this ridge is wholly wanting in the interior whorls. The increase in breadth being more rapid than the increase in height occasions the thickness in the inner whorls to be a little less than that of the outer ones. The back is also smaller in consequence, and the side more flat and more distinctly separated from the back. For this reason also the lateral lobe in the inner whorls is indicated on the side by an imperfect curve of the transverse plate, whilst in the outer whorls the dorsal lobe widens, and extends over the back in such a manner that it has properly speaking no existence, except as a large and rounded dorsal saddle.

In fig. 3, Pl. I. the lobes are represented as they begin to appear at first, in the specimen shown in figs. 1, 2, with a whorl and half destitute of transverse plates; in fig. 4 are the lobes of another specimen, of which only the three innermost whorls are preserved. The shell of this ammonite was striated, as may be distinctly seen upon the cast: the striæ are inflected behind, upon the back, according to the ordinary law for *Goniatites*, forming a very deep curve. I have chosen the name *lateseptatus* on account of the considerable distance of the transverse plates from each other, which is so great that there are only 10 or 11 of them in one whorl, whilst in general 14 seems the lowest limit for the number of transverse plates of the *Goniatites*.

3. *Ammonites Dannenbergi*, n. s. Pl. I. fig. 5: a, b.

The dorsal lobe infundibuliform, the depth twice as great as the breadth; the lateral lobe sinks a little deeper than the dorsal lobe; it entirely occupies the side and ascends towards

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The dorsal lobe infundibuliform, the depth twice as great as the breadth; the lateral lobe sinks a little deeper than the dorsal lobe; it entirely occupies the side and ascends towards

the suture, but not quite to the height of the dorsal saddle. The increase in height is 0·28; the increase in breadth 0·5. There are 18 chambers in one whorl. The interior whorls are not at all enveloped, but entirely free. The only specimen that I am acquainted with is in the beautiful collection of M. Dannenberg at Dillenburg; the figure is taken from a model in plaster. It is a fragment of which only two whorls are preserved; it wants the interior whorls and the outer unchambered part. The form is completely discoid, from its more rapid increase in height than in breadth. This ammonite is thus distinguished from the *A. expansus*, which has the whorls entirely enveloped. In the latter the height increases still more rapidly, yet has less disproportion with the increase in breadth. If we suppose that in this ammonite, according to the ordinary law, there is a whorl and a half without chambers, it will be found from the proportion of the increase in height, that the diameter of the entire shell would be nearly a foot. The thickness ought in this species to diminish very rapidly, since the breadth of the mouth increases much more gradually than the height. The dimension is, at the commencement of the first of the two whorls preserved, 0·7; at the commencement of the second, 1; and at the termination of the second, 1·5. The greatest thickness is at the middle of the side; it decreases however, but gently, till approaching the suture and the back. Upon the outer of the two whorls the back is completely rounded, and passes gradually to the side. Upon the inner whorl it becomes flat, and at the commencement of the second whorl it forms almost a right angle with the sides. Probably there was upon the shell, between the back and the two sides, two sharp edges, the impression of which may be seen upon the cast. These edges limit the inflected curve behind, which is formed by the striæ of the shell and the back: they gradually disappear upon the outer whorls. We shall see in many of the following species this difference in the manner in which the back is united to the sides, in the exterior and interior whorls. The lobes of *A. Dannenbergi* are not essentially different from those of *A. subnautilus*. The dorsal saddle is always somewhat narrower and higher; the lateral lobe, on



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the contrary, is a little deeper: the last rises evidently to form a lateral saddle. It does not ascend, as in *A. subnautilus*, quite to the suture, and is not cut off in an abrupt manner, but inflected considerably upon the side. (See M. von Buch, fig. 3 and 9. pl. I.) This difference is because in *A. subnautilus* each saddle that unites the lateral lobe with the flat ventral lobe, which exists in that ammonite, is compressed beneath the suture, in consequence of the decided envelopment of the interior whorls.

4. *Ammonites compressus*. Pl. I. fig. 6 *a, b*.

*Spirula compressa*, Goldf. *Dechen Geogn.* p. 536.

*Gyroceratites gracilis*, H. v. Meyer. *Act. Nat. Cur.* 1831. XV. II. p. 59.

*Bronn. Leth. geogn.* p. 102. pl. I. fig. 6.

The dorsal lobe very small, infundibuliform, two or three times as deep as broad. The lateral lobe is almost entirely wanting, or at most only indicated by a very imperfect curve on the transverse plates of the chambers. The increase in height is 0·3, the increase in breadth 0·5. There are 15 chambers in a whorl; the number of whorls is from 4 to 5. This ammonite has not any part enveloped; the innermost whorls are entirely free.

It is not an unfrequent fossil in the clay slate of Wissenbach (Thonschiefer), nevertheless the specimens are seldom well preserved: they often want the innermost whorl, and frequently the exterior portion or that destitute of chambers. This must have been the reason why Goldfuss called it a *Spirula*, and H. von Meyer made it a distinct genus, under the name *Gyroceratites*. The lobe distinctly exists, though certainly small, and proves it to be really a Goniatite. The whorls are by no means separated one from another, as in the *Spirula*, but in contact with each other, although but slightly. The greatest thickness is in the middle of the side, which gradually diminishes, both towards the back and towards the suture, in such a manner that the section of the mouth is an ellipsis. One consequence of this is, that in the casts where the shell is wanting there is really a little interval between the whorls; that space appears still larger if the particles of schist between these whorls have not been taken off with sufficient care.

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It is not an unfrequent fossil in the clay slate of Wissenbach (Thonschiefer), nevertheless the specimens are seldom well preserved: they often want the innermost whorl, and frequently the exterior portion or that destitute of chambers. This must have been the reason why Goldfuss called it a *Spirula*, and H. von Meyer made it a distinct genus, under the name *Gyroceratites*. The lobe distinctly exists, though certainly small, and proves it to be really a Goniatite. The whorls are by no means separated one from another, as in the *Spirula*, but in contact with each other, although but slightly. The greatest thickness is in the middle of the side, which gradually diminishes, both towards the back and towards the suture, in such a manner that the section of the mouth is an ellipsis. One consequence of this is, that in the casts where the shell is wanting there is really a little interval between the whorls; that space appears still larger if the particles of schist between these whorls have not been taken off with sufficient care.

the contrary, is a little deeper: the last rises evidently to form a lateral saddle. It does not ascend, as in *A. subnautilus*, quite to the suture, and is not cut off in an abrupt manner, but inflected considerably upon the side. (See M. von Buch, fig. 3 and 9. pl. I.) This difference is because in *A. subnautilus* each saddle that unites the lateral lobe with the flat ventral lobe, which exists in that ammonite, is compressed beneath the suture, in consequence of the decided envelopment of the interior whorls.

4. *Ammonites compressus*. Pl. I. fig. 6 *a, b*.

*Spirula compressa*, Goldf. *Dechen Geogn.* p. 536.

*Gyroceratites gracilis*, H. v. Meyer. *Act. Nat. Cur.* 1831. XV. II. p. 59.

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The drawing given by Bronn in the 'Lethæa-geognostica' has certainly not been taken from nature, but probably from the description of H. von Meyer. The *Gyroceratite* of the latter is certainly only referrible to this fossil. Bronn gives as a synonym a *Lituities gracilis*, Goldf. Collect.; certainly there is in the Museum at Bonn a fossil designated as *Lituities*, but it is another fossil: it presents no chambers, and I think is a cast of *Euomphalus*, perhaps *Eu. lævis*, Goldf.

With regard to the increase in height and in breadth, the *A. compressus* is very near the *A. Dannenbergi*; it is principally distinguished from this by the simple lobes, and it never attains the size of the latter. There are neither ventral nor lateral lobes in this species; this Ammonite has in common with *A. lateseptatus* the simplicity of lobes. In the specimen figured Pl. I. fig. 6. there is a portion of the part without chambers preserved. It may be very distinctly seen, by the striæ upon the shell, that it was very thin.

The species described here, to which *A. expansus*, von Buch is nearly allied, form a group among the *Goniatites*, limited in a very natural manner. Except the dorsal lobe, which can always be very distinctly seen, there is nothing very particular to be said about the lobes. There is only a very slight inflexion of the transverse plates, that in every individual occupies the entire side quite to the suture. We cannot arrange here with certainty any of the *Goniatites* of the old transition limestone of the Fichtelgebirge described by Count Münster; *A. latus* and *A. angustiseptatus* can only be added to this section as doubtful species.

#### Section II. SIMPLICES.

The dorsal lobe simple, infundibuliform or linguiform. There is a lateral lobe more or less angulose, and a broad lateral saddle occupying the greatest part of the side.

5. *Ammonites retrorsus*, Von Buch. Pl. I. fig. 10. *a, b, c.*  
*L. de Buch Goniat.* p. 49. Pl. II. fig. 13.

The dorsal lobe small, infundibuliform, almost as broad as deep. The lateral lobe is rounded beneath, more than twice as deep as the dorsal lobe, and a little broader than deep. The lateral saddle, broad and rounded, is also raised to the dorsal

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saddle, occupies half the side, and is gently hollowed in approaching the suture. The increase in height is 0·45, the increase in breadth 0·65; this Ammonite is altogether enveloped without an umbilicus. It is found with the *Goniatites* of the limestone of Oberscheld near Dillenburg, and in the Martenberg mine in the territory of Waldeck. The specimens that I possess of the first locality are at the most one inch, and otherwise altogether resemble those of Waldeck. This Ammonite has nothing but the enveloped form in common with *A. Munsteri*, which M. von Buch believed to be allied to *A. retrorsus*; on the contrary, it agrees so closely in the form and lobes with *A. simplex*, von Buch, that perhaps they ought not to be separated as distinct species. For the increase in height M. von Buch gives for *A. retrorsus* only 0·32, and for *A. simplex* 0·4; in all cases the height in both increases more rapidly than the breadth, so much so that the thickness in the outer whorls diminishes very fast, and the larger the Ammonite is the more discoid is its form. In *A. simplex*, as M. Buch has described and figured it, the dorsal lobe is considerably larger and the lateral lobe smaller, and of the same depth as the dorsal lobe. That is the only distinction between this Ammonite and *A. retrorsus*. The name of *retrorsus* is given from the very delicate striæ seen on the shell. On the lateral surface the terminations of the folds form a very smooth curve, inflected behind: they ascend again afterwards towards the back, and form above a narrow and deep sinus, the concavity of which is directed towards the front. The breadth and depth of the dorsal sinus appear to correspond to the breadth of the back in the different species. The smaller the back the deeper and more contracted is the sinus: in *A. lateseptatus* and *A. Listeri* it is very large and flat.

The *A. retrorsus* is the only species in this section that up to the present time has been found in the schistose rocks of the Rhine. *A. simplex*, which is nearly allied to it, and which is said to be found at Rammelsberg near Goslar, comes perhaps from the limestone of Grund, the fossils of which have a near affinity to those of the transition limestone of the Eifel. To these two Ammonites the *A. ovatus*, Münster, is intimately allied. The description gives us no important difference either



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in the form or in the lobes. The principal part of this section is composed of numerous species of the transition limestone of the Fichtelgebirge, discovered by Count Münster, *A. nodulosus*, *A. sublaevis*, *A. globosus*, *A. sublinearis*, *A. linearis*, *A. divisus* and *A. hybridus*. We may add as forming a third subdivision, *A. sulcatus* and *A. subsulcatus*, Münster, which distinguish themselves by their lateral linguiformed lobe, and are somewhat related to the following section: they have nevertheless the lateral saddle broad and rounded, which occupies the greater part of the side.

### Section III. ÆQUALES.

The dorsal lobe simple, linguiform or infundibuliform. There are two or more lateral lobes, that become successively greater or smaller in approaching the suture.

#### 6. *Ammonites Becheri*, Goldf. Pl. I. fig. 7, 8.

*L. de Buch Goniol.* p. 39. Pl. II. fig. 2.

The dorsal lobe infundibuliform; on the side which is slightly vaulted are found four linguiform lateral lobes, which become smaller and smaller in approaching the suture. The first of these is twice as deep as the dorsal lobe; the fourth is but two-thirds the depth of the first, after it comes a considerable ventral saddle that is twice as broad as the third lateral saddle. The increase in height is 0·4, the increase in breadth 0·65. There are seven whorls; almost two-thirds of the inner ones are enveloped. This Ammonite occurs in the red limestone, amongst the *Goniatites* of Beilstein, near Oberscheld; it is also found in the hematitic iron of the mine of Rinzenberg. It appears to come very near *A. Henslowi*, Sow., but this has only three lateral linguiformed lobes. As it augments much more quickly in height than in breadth, its form is discoid, and the thickness rapidly diminishes. Its contour presents an elliptical appearance, as always happens when the height increases much faster than the breadth. The shell is rarely well preserved; it is thick and plaited: between the folds are found regular spaces, with numerous finer folds. The greatest thickness is near the suture; the side slightly vaulted falls gently towards the back; the latter forms

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The dorsal lobe infundibuliform; on the side which is slightly vaulted are found four linguiform lateral lobes, which become smaller and smaller in approaching the suture. The first of these is twice as deep as the dorsal lobe; the fourth is but two-thirds the depth of the first, after it comes a considerable ventral saddle that is twice as broad as the third lateral saddle. The increase in height is 0·4, the increase in breadth 0·65. There are seven whorls; almost two-thirds of the inner ones are enveloped. This Ammonite occurs in the red limestone, amongst the *Goniatites* of Beilstein, near Oberscheld; it is also found in the hematitic iron of the mine of Rinzenberg. It appears to come very near *A. Henslowi*, Sow., but this has only three lateral linguiformed lobes. As it augments much more quickly in height than in breadth, its form is discoid, and the thickness rapidly diminishes. Its contour presents an elliptical appearance, as always happens when the height increases much faster than the breadth. The shell is rarely well preserved; it is thick and plaited: between the folds are found regular spaces, with numerous finer folds. The greatest thickness is near the suture; the side slightly vaulted falls gently towards the back; the latter forms

with the sides two ridges, entirely immersed, between which are found the folds of the dorsal sinus.

Besides *A. Becheri* and *A. Henslowi*, I place in this section *A. Münsteri*, von Buch, *A. orbicularis*, Münster, and also *A. planus*, Münst., which are all three found in the transition limestone of the Fichtelgebirge, and are characterized by the lateral lobes becoming larger and larger as they approach the suture. This distinction establishes in the section two very natural subdivisions.

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III.—*Descriptions of some New or rare Indian Plants.* By  
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SCHIZOSTIGMA, Arn. (*Rubiaceæ*).

*Calycis* tubus globosus, limbus 5-partitus, laciniis lanceolatis. *Corolla* infundibuliformis, intus pubescens, extus hirsuta, ad medium usque 5-fida, laciniis lineari-lanceolatis patulis. *Antheræ* 5, lineares, obtusæ, ad faucem sessiles. *Ovarium* cohærens, multiloculare, loculis multiovulatis. *Stylus* filiformis, stamina longe superans. *Stigma* multi- (4—7) fidum, segmentis linearibus patulis. *Fructus* indehiscens, baccatus, globosus, costatus, hirsutus, laciniis calycinis foliaceis patentibus coronatus, pluri-(4—7) locularis, loculis polyspermis.

*Herba* decumbens vel subrepens, hirsuta. *Caules* simplices, 4—8 poll. longi. *Folia*,  $1\frac{1}{2}$ —2 poll. longa, opposita, longiuscule petiolata, oblongo-lanceolata, integerrima, supra viridia, parcius pilosa, subtus pallida. *Stipulæ* interpetiolares, late ovatæ, acutæ, membranaceæ. *Flores*, 8—9 lin. longi, axillares, solitarii, alterni, subsessiles, basi bracteis duabus stipulis subsimilibus stipati.

1. *S. hirsutum*, Arn.

*Hab.* in insula Ceylon.

This genus may be placed near *Sabicea*.

ACRANTHERA, Arn. (*Rubiaceæ*.)

*Calycis* tubus oblongo-turbinatus, limbus 5-fidus, laciniis linearibus. *Corolla* tubulosa, intus glabra, extus hirsutissima, ultra medium 5-fida, laciniis erectis, spatulatis, retusis, æstivatione valvata plicata. *Stamina* 5, erecta, basi corollæ inserta, ea dimidio breviora ac ejus laciniis alterna: filamenta filiformia subpapillosa: *antheræ* innatæ, oblongo-lineares, connectivo apice in mucronem longiusculum ultra

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